Anaerobic Digestion: Hope or Hype?

Renewables for Rural Prosperity,

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Agenda

- Portland General Electric and Biogas
- Digester Basics
- Opportunities, Challenges, Risks
- Project Portfolio
- Lessons Learned
- (My) Conclusions: hope? hype?
- Questions/Discussion

PGE and Biogas

- Portland General Electric
- Why biogas
- How we started
- What we've been doing

Digester Basics

- What to feed
  - Be careful about bedding materials
  - Minimize and manage debris
  - Opportunity for supplemental feedstock (e.g. fatty acids)
- How much to feed
  - Concentration of digestible solids
  - Steady loading

Digester Basics

- Retention Time
- Temperature
  - Mesophilic: 95-100°F
  - Thermophilic: 130-135°F
  - Technical challenge - raising the temperature of incoming materials while balancing availability of waste heat

Digester Benefits

- Utilities: “continuous” supply of renewable energy
- Dairies
  - Reduce manure solids (volatile solids to biogas)
  - Nutrient management:
    - digesters do not remove N, P, or K
    - N is mineralized
    - Increased flexibility regarding land application
  - Odor reduction

Opportunities, Challenges, Risks

- Opportunities (from a convergence of)
  - Increasing environmental constraints on producers
  - Developing markets for organic fiber
  - Niche opportunities for locally-generated green power
  - Consumer interest in green power—
    potential for premium pricing

Opportunities, Challenges, Risks

- Challenges
  - Developing projects as a third-party with no need for capital contributions from dairies
  - Selling enough electricity and fiber to repay investment over a reasonable time horizon
  - Providing significant environmental benefits to host dairies (e.g. a “systems” approach toward reductions in N,P,K)
  - Uncertainties regarding energy prices (how much will utilities, including our own, pay?)

Opportunities, Challenges, Risks

- Risks
  - Spotty operating history of US farm-based digesters from shortages of:
    - Capital
    - Broad-based, integrated, field-based research
    - Good design documentation and as-builts
    - Long-term O&M support
  - Recent volatility of energy markets

PGE Project Portfolio

- Cal-Gon Farms, Salem
  - High solids (12%)
  - 1 cast-in-place concrete tank
  - Capacity: at 500 cows, 12-day retention time
  - Mesophilic or thermophilic operating capabilities
  - 100 kW electrical capacity
  - Screw-type separator
  - Construction completed last December
  - Currently completing start-up
    (electricity to the grid on March 7th)

Cal-Gon

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Cal-Gon

Cal-Gon

Cal-Gon

PGE Project Portfolio

- ThreeMile Canyon Dairies, Boardman
  - Medium solids (6-8%)
    (thickened from flushed manure slurry of 2%)
  - 2-steel tanks
  - Capacity: 20,000 cows, 12-day retention time
  - Thermophilic operating temperature
  - 4,000 kW generating capacity
  - Screen separators
  - Begin construction Q2’02
  - Commercial operation prior to end of 2003

Lessons Learned

- Lots of information
  - Everybody has an opinion
  - There are lots of companies ready to sell
  - Some sales claims seem too good to be true
- Need to effectively filter all of this information

Lessons Learned

- Digesters must be integrated into a comprehensive manure management process
- Significant research and documentation is still required to demonstrate digester benefits
  - “Benefits” rather than “performance”
  - Specific contributions within a process

Lessons Learned

- Difficult to find the right combination of up-to-date technical information and operating experience
  - Even though the basic technology is pretty well understood
  - Digester research appears to be on the rise, but tends to focus upon sub-systems or regional solutions
  - Not much research focused upon the application side:
    optimizing gas production;
    increasing the market value of digested fiber; or
    application of digester solids and liquids

Lessons Learned

- Difficult to find the right combination of up-to-date technical information and operating experience
  - Value in talking to multiple developers, engineers, vendors, researchers, producers (but this increases transaction costs).
  - Flexible technical solutions required.
  - Standardization to reduce costs
    (and we need to reduce costs!)

Lessons Learned

- Larger projects (>1,000 cows) are easier
  - Better fit with more “conventional” technologies
  - Project economics are more robust
  - We continue to search for solutions for smaller dairies

Lessons Learned

- Low interest loans, tax credits, and subsidy programs critical to project development
  - Oregon projects can benefit from
    - Business Energy Tax Credit (BETC)
      35% over five years
    - Small Energy Loan Program (SELP)
  - A three-year federal tax credit should be in place soon

What's Next (for PGE)

- Balance
  - interest in additional projects
  - while gaining significant operating experience
- Develop
  - A select group of projects to advance our understanding of critical issues
  - Partnerships/alliances
  - A way to encourage/support/ participate in critical research